

Appl. No. 10/681,497
Response to OA of 4-14-09

Remarks/Arguments

The Applicant requests the claims following amendment be accepted. Each objection of the 4-14-09 OA is addressed.

General Arguments

The following three general arguments will apply to all of the remaining OA objections.

General Argument I. Naturally occurring calcium borates (Colemanite and Ulexite) are very poor flame retardants when used in non halogenated plastics (such as polyethylene and EPDM) and/or cellulosic material. Producing an adequate flame resistant composite with either of these compounds requires a 35% or higher loading. One skilled in the art would not consider their use as a fire retardant in the percentages of either Lloyd (4% max) or this present invention (12% max in claim 1 or 5% in claim 3)).

a. Pitts (USPN 3865760) teaches that Colemanite must be loaded to 150% of the weight of rubber to adequately flame retard that material. Table I (3:40-50) shows that 150 parts of Colemanite in 100 parts of rubber is necessary to establish an Oxygen Index of 29, which is just above the value of 28 required to declare a material non-burning.

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Pitts also teaches the flame retardancy characteristics of Colemanite are about the same as those of aluminum trihydrate (3:60-67). As described by Guo et al in *Flame Retarding Effects of Nanoclay on WoodFfiber Composites* (submitted in the attached IDS), loading levels of aluminum trihydrate in wood plastics of more than 60% are required to achieve proper flame retardancy.

b. Kuckro (USPN 6096816) teaches that Colemanite loadings of a minimum of a 2:1 polymer to Colemanite ratio (ie 50% loading) is required to achieve adequate flame retardance (4:33-41 and 4:50-53). Kuckro teaches this ratio for many types of polymers (3:5-11).

c. Panusch (USPN 4076580) teaches that Ulexite and Aluminum Trihydrate are approximately equally effective in flame retardancy of cellulosic composites but a mixture of the two has synergistic properties (3:23-41). However even with this synergistic capability a mixture of the two compounds requires a loading of 35% -50% to achieve flame retardancy in a $\frac{1}{4}$ inch hardboard (3:60-65). Use of Ulexite alone would require an even higher loading.

General Argument II. Although Zinc Borate when used in a non-halogenated plastic (such as a polyethylene or high density polyethylene) is a relatively inefficient flame retardant, it is five times more effective than Colemanite. One skilled in the art would not be motivated to use Colemanite as a replacement for Zinc Borate in a fire retardant application.

a. O'Brien (USPN 5525757) teaches a minimum zinc borate loading of 7.1% (see Amendment of 1-28-09) is required to provide adequate fire retardancy which is five times less than the minimum Colemanite loading of 35%.

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General Argument III. At the time of the invention most wood plastic composite experts believed there was no need to protect the wood component from decay. For those dissenting experts, a study indicated that at most a 1% loading of Zinc Borate was all that was needed to protect under extreme conditions.

a. Verhey et al in *Laboratory Decay Resistance of Woodfiber/Thermoplastic Composites* (submitted in IDS 1 as part of the original submission on 10-8-03) explain: "The hydrophobic nature of the plastic matrix and its inherent high biodegradation resistance are believed to provide sufficient resistance to fungal degradation without the use of preservative chemicals. If the plastic and wood are mixed in such a ratio that a continuous plastic phase exists in the composite, the wood particles should be encapsulated and protected from the effects of moisture and fungal effect (p1 col 1)".

Verhey then reviewed the existing literature which showed (a) two studies with no decay effects, (b) one study with straw that had low decay, (c) another study that indicated no significant decay in a composite with as much as 70% wood, and finally a study that observed no significant decay at 50% wood loadings and some attack at higher wood loadings (p1 col 3).

Verhey then performs a series of experiments at varying wood and zinc borate loadings and arrives at the conclusion that a 1% loading of Zinc Borate is sufficient to protect the wood from decay (p5 Fig 3 and p5 col 3).

b. The Specification of this present invention identifies that zinc borate of 1.5% was used in lignocellulosic composites. As Verhey identifies, the larger the wood component

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the more susceptible the composite is to decay. Wood composites are 85% wood – wood plastic composites contain at most 70% wood and the plastic serves as a barrier to decay; therefore Verhey's finding that less preservative (1% vs 1.5%) is consistent.

c. The Example II of the current invention shows that decay is inhibited in a wood plastic composite containing 70% wood, which per Verhey is a worst case wood content, only required a 2% colemanite loading.

Arguments regarding OA 2: Claim 5

Claim 5 has been amended to eliminate this objection.

Arguments Regarding OA 4: Claims 1, 3-6, 8-12, and 14

- Aida (USPN 5221781) in view of Lloyd (USPN 6368529)

Claim 3: OA 4 at p4 : "Aida lacks sufficient specificity to anticipate the claimed range. However the claimed range would have been prima facie obvious over Aida's teachings to use the materials in combinations of two or more and to adjust these ranges, making the amount of zinc borate a result-effective variable."

There are two aspects to adjusting a results effective variable: (a) knowing the correct variable to adjust and (b) knowing the desired result. If a flame retardant result is required, the lowest loading possible would be the use of zinc borate in excess of 7% (General Argument II); this is well in excess of 5% of claim 3. If Lloyds result (prevention of decay) is the desired outcome, then a only 1% loading of zinc borate is required (General Argument III); this is much less than the 3% of claim 3.

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None of the prior art teachings suggest a desired result of mold resistance. This is not an obvious result and would not have been discovered by adjusting the boron containing chemical loading to achieve decay resistance, since this only requires < 2%.

Regarding flame retardancy: per MPEP 2143.01 V-- "The proposed modification can not render the prior art unsatisfactory for its intended purpose." Loading a composite with 5% of zinc borate or colemanite would leave the material without adequate fire retardant characteristics, leaving Aida unsatisfactory for its intended purpose of fire retardancy.

Claims 6, 8, 9, & 12: The OA argues that one of ordinary skill would substitute calcium borate for zinc borate per the benefits stated in Lloyd. In previous amendments, augmented by the information in General Argument III, Applicant has argued that both these benefits do not apply to wood plastics.

Further one skilled in the art would not replace zinc borate with colemanite in Aida's application (OA p3) because the latter requires five times as much material to be an effective flame retardant (General Argument II).

Arguments Regarding OA 5: Claims 1, 3-5,6, 8,9,12, and 15

- Touval (USPN 3926883) in view of Pelikan (USPN 4104207)

In addition to the arguments regarding unexpected results presented in the 1-28-09 Amendment, Applicant argues the following:

- a. Touval requires stannic oxide in the composite at a very specific ratio of 1:4; if it is not present in this ratio the material is not flame retardant (1:60-67). The present invention has no need of stannic oxide.

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b. Touval identifies the overall ranges for flame retardants of 0.5 -25 phr is comprised of two components. The first, 0.5 -10 phr is applicable to polymers containing halogens, such as polyvinyl chloride. The 4-25 phr is for polymers such as polyethylene, which do not contain halogens. The present invention teaches the non-halogen containing polymers.

Further, Applicant continues to argue that Touval teaches that more than 16% colemanite is required to provide flame retardancy in a polyethylene composite – a conclusion consistent with General Argument I.

Arguments Regarding OA 6: Claims 1, 3-6, 8-12, 15, 16, and 18

- Pelikan (USPN 4104207) in view of Lloyd (USPN 4104207)

Per General Argument III, a loading of 1% zinc borate or at most 2% of colemanite is required to prevent decay in wood plastic composites; this is much less than the 2% of claim 1. Per General Argument II a loading of 35% colemanite is required to provide flame retardancy which is much greater than the 12% of claim 1.

Further Applicant notes that General Argument III is very conservative when Pelikan's teachings are considered, since he allows a maximum lignocellulosic content of 23% of the total composite weight.

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Applicant disputes the OA position at p6 that Pelikan teaches the vegetable material may comprise 50% to 95% of the thermoplastic which is based on 6:29-30. This reference to 5-50% refers to the fillers, softeners, stabilizers, pigments, fireproofing agents, etc of 6:22-24.

Applicant argues that the vegetable material, which includes the carrier and gas bubble forming material, is between 5% and 25% of the plastic material. Three references support this position:

- a. "The portion of vegetable substance, including water and gas bubble forming material should be between 5 and 25% by weight calculated on the utilized plastic material, including all fillers and ancillary agents (6:43-46)."
- b. The Example (6:57-68) shows that the lignocellulosic material, including 10% water, is 8 parts which would be 8% of the thermoplastic; within the 5-25% range and well outside 50-95%. The total composite is 202.6 parts, making the lignocellulosic portion equal to 3.5% [(8 x.9) /202.6] of the total composite.
- c. Claim 30 states the total weight of the carrier and gas bubble forming medium added to the plastic material is 5-25% of the weight of the plastic material. This claim would not be enabled if the specification disclosed a 50-95% range.

Verhey at p4 col 3 states there is little decay in the wood plastic composites where the content is 30% to 50% of the total composite weight. Since one skilled in the art at the time of the invention had access to Verhey, they would realize there is no motivation to add a preservative to a composite with such a low wood content.

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Claims 16, 18, &20 Pelikan requires a “gas bubble forming medium such as water or aqueous dispersion” (abstract). This medium is 8% to 30% of the weight of the carrier (6:47-50) which can be a lignocellulosic material. Neither claim 16, 18 or 20 contains such a gas forming medium.

Claims 19 & 20: Pelikan teaches a maximum lignocellulosic material of 23 % of the total weight of the composite and this would occur only when there are no other fillers present. Claims 19 & 20 have the lignocellulosic material at greater than 40% of the total composite weight.

Arguments Regarding OA 7: Claims 1, 3-6, and 14

- **Pelikan (USPN 4104207) in view of Borogard ZB**

Applicant disagrees with the OA using arguments provided for OA 6. In addition, General Argument I describes why one skilled in the art would not consider substituting colemanite for zinc borate as a fire retardant as it takes 5 times as much of the former compound to be effective.

Arguments Regarding OA 10:

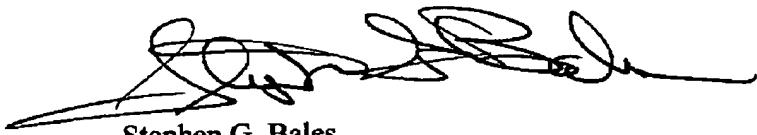
- **Pelikan (USPN 5435954)**

The arguments above in Aida in view of Lloyd also apply to Wold.

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For all the above reasons, as well as those presented in the previous amendments,
Applicant respectfully submits the distinctions are of patentable merit. Accordingly
Applicant submits this applications is now in full condition for allowance.

Respectfully submitted,



Stephen G. Bales
17 Hart Lane
Sewell, NJ 08080

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Appendix A
Claims

1. (Previously Presented) In the method for forming lignocellulosic polyolefin composite products containing 25 to 75 percent by weight of the polyolefin material such as to increase their resistance to surface visual impairment caused by mold attack, the improvement which comprises incorporating an amount of a cationic salt of boric acid in the range of from about 2 to 12 percent by weight of said composite product prior to forming said composite product.
2. (Canceled)
3. (Previously Presented) The method according to claim 1 in which said amount of cationic salt of boric acid is in the range of from about 3 to about 5 percent by weight of said composite.
4. (Original) The method according to claim 1 in which said lignocellulosic material is selected from the group consisting of wood, ground rice hulls, kenaf, jute, and coconut shells.
3. (Currently Amended) The method according to claim 1 in which said polyolefin material is selected from the group consisting of polyethylene, high density polyethylene, polystyrene and polypropylene.
6. (Previously Presented) The method according to claim 1 in which said cationic salt of boric acid is calcium borate.
7. (Canceled)

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8. (Original) The method according to claim 6 in which said calcium borate is a naturally occurring borate.
9. (Previously presented) The method according to claim 8 in which said calcium borate is selected from the group consisting of ulexite and colemanite.
10. (Previously Presented) The method according to claim 1 in which said polyolefin material is polyethylene or high density polyethylene.
11. (Canceled)
12. (Previously Presented) The method according to claim 8 in which said calcium borate is colemanite.
13. (Canceled)
14. (Previously Presented) The method according to claim 1 in which said cationic salt of boric acid is zinc borate.
15. (Canceled)
16. (Currently Amended) In the method for forming composite products consisting of a polyolefin material which is 25 to 75 percent by weight of the total composite, a lignocellulosic material, and at least one of the group consisting of a lubricant, a cross-linking agent, a UV stabilizer, ~~a blowing agent~~, an inhibitor, and a coupling agent such as to increase their resistance to surface visual impairment caused by mold attack, the improvement which consists of incorporating an amount of a cationic salt of boric acid selected from the group of synthetic calcium borate, colemanite, ulexite, or mixtures thereof in the range of from about 2 to 12 percent by weight of said composite product.

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17. (Canceled)

18. (Previously Presented) In the method for forming composite products consisting of lignocellulosic high density polyethylene and at least one of the group consisting of a lubricant, a cross-linking agent, a UV stabilizer, an inhibitor, and a coupling agent such as to increase their resistance to surface visual impairment caused by mold attack, the improvement which consists of incorporating an amount of synthetic calcium borate, colemanite, ulexite or mixtures thereof in the range of from about 3 to 5 percent by weight of said composite product prior to forming said composite product.
19. (New) The method according to claim 1 in which said amount of lignocellulosic material is in the range of from greater than 40% to about 70% of the total composite weight.
20. (New) The method according to claim 18 in which said amount of lignocellulosic material is in the range of from greater than 40% to about 70% of the total composite weight.